SA River Murray Floodplain
Water for the Environment Case Study

Johnsons Waterhole

M Harper

2020

Acknowledgement for Contribution

This Case Study was produced with significant input from Dr Anne Jensen, Kate Strachan, Rosalie Auricht and Anna Harper.

Contents

Front Cover Figure: A Jensen.

1 Summary

This case study describes the changes in vegetation between 2011 to 2020 from the combination of natural flood events and Water for the Environment watering activities at Johnsons Waterhole (a salinized temporary wetland). Data used to assess the changes in vegetation centred on two site surveys and photographs taken of the site by a number of people. Over this period, and with at least yearly inundations for seven years with the first two years consisting of natural flood events, Johnsons Waterhole moved from a highly saline wetland dominated by Samphire, to a wetland in transition where less saline tolerant plant species have established. Highly salt-tolerant samphire plants are now in the minority. The wetland now also supports a range of medium to low salt tolerant plant species during the wetland drawn down and dry phases. Historical revegetation actions adjacent to the wetland have influenced natural regeneration of tree species at the site. It has taken yearly inundation events over five years for the floristic composition of the wetland to begin changing. This indicates that the frequency and number of inundation events was critical for Johnsons Waterhole to begin the transition away from a highly salinized site. It can therefore be suggested that a significant environmental watering commitment is required to reverse the biodiversity loss at a salinized temporary wetland. Once a new balance in biodiversity is achieved, watering frequency can be reduced to mimic natural inundation patterns. However, the wetland could become salinized again if dried for more than two years.

2 Introduction

Johnsons Waterhole temporary wetland is located adjacent to Ral Ral Creek, a permanent floodplain anabranch upstream of Renmark Township. It is adjacent to the Renmark Irrigation Area. The site is managed by a partnership between the Renmark Irrigation Trust and the Renmark Paringa District Council. The wetland and part of the adjoining flow path between the Ral Ral and Bookmark Creeks received pumped environmental water for the first time in November 2013. With the placement of hydrological infrastructure approximately 19 hectares can now be inundated at the site (see Figure 1).

Figure 1. Johnsons Waterhole environmental watering site October 2014

The inlet to the wetland commences flow from the Ral Ral Creek at approximately 35,000 ML/d. When the river flow band exceeds 50-60,000ML/d the flow path between the Ral Ral and Bookmark Creeks is inundated.

Historically, the riparian edge of Johnsons Waterhole and the adjacent flow path was dominated by open River Red Gum *Eucalyptus camaldulensis* woodland with Lignum *Duma florulenta* understory. The wetland would have filled nearly every spring and would have been flooded for many months. The wetland would have held water for many more months following the flood recession. The name of the wetland Johnsons Waterhole suggests that water was most likely held at the site for long periods of time. As indicated in Figure 2 the wetland still received and held water for extended periods in the 1950s as Cumbungi *Typha domingensis* was common along the riparian edge. Figure 2 also shows that the large adult River Red Gums were already dead by the 1950s. The remaining dead River Red Gum skeletons at the site (Figure 3) are evidence of the once-thriving floodplain habitat. It is locally recognised that this wetland was originally impacted by the increase in saline groundwater elevation from the construction of the weir at Lock 5, and further exacerbated by the increase in the saline groundwater mound under the adjoining horticulture flood irrigation area. In later years the lack of freshwater flows also added to the site's soil salinization.

Figure 2. Johnsons Waterhole showing Bulrush riparian fringe in 1950s (photo: Dudley Foweraker)

Figure 3. Dead River Red Gum on Johnsons Waterhole edge (Photo: A Jensen)

Prior to the commencement of the site receiving Water for the Environment in November 2013, there was a significant strip of Samphire *Arthrocnemum spp.* below the line of dead River Red Gums. Above the dead River Red Gum line Samphire dominated however there were odd scattered young Lignum bushes and sapling Cooba *Acacia stenophylla* especially at the Ral Ral Creek end. The centre of wetland bed was bare soil with little structure (Figures 4 and 5).

Figures 4 and 5. Views of Johnsons Waterhole 2013 (Photo: A Jensen and P Hunter)

3 Johnsons Waterhole Watering

Between 2011 and 2018 Johnsons Waterhole was inundated every year either by a natural flood event or by pumped Water for the Environment. During 2012, 2014 and 2018 the wetland received two water pulses during the year (Table 1). During the first two years the wetland was inundated by natural flood events leading to the conclusion that the majority of surface salinity would have been flushed from the site. It is presumed that the wetland did dry out between most watering events but no formal records were kept. However, the wetland was still partly inundated after eight months from the October 2015 inundation. Photographs have identified the following years when

drying occurred; 2012, 2013, 2016 and 2019 to 2020. The most recent dry period has been the longest.

Table 1. Johnsons Waterhole Watering between 2011 and 2020. (Data from Johnsons Waterhole - Water For Nature Environmental Watering Site Monitoring Report (2013-16) A Jensen and K Strachan and R Auricht (per com.) Renmark Irrigation Trust)

Year	Natural Flood Event Flows into SA	Environmental Watering Event Commenced
2011	86,000ML/d – February	
2012	59,000 ML/d – April 50,000ML/d – October	
2013		November
2014		March October (top up)
2015		October
2016	94,000ML/d - November	
2017		August/September
2018		April/May August/September (top up)
2019		Dry Year
2020		Due for water in August

4 Floodplain Vegetation Response

Over the period of this case study detailed vegetation monitoring was not undertaken by the E-water practitioners. However, a number of people involved in the project recorded events of interest. The following description of the riparian vegetation changes over the 2011 to 2020 period has been collated from the following reports and a number of site photographs; (Jensen and Strachan 2016, Harper and Harper 2016, M Harper unpublished survey data and photographs from A Jensen, K Strachan and M Harper). Native riparian and low shrub species were planted on the edge of the wetland in 2014 and 2015 with mixed results (K Strachan per com.).

4.1 Johnsons Waterhole Bed

During the October 2014 inundation draw down period, Red Water-Milfoil *Myriophyllum verrucosum* dominated the wetland (Figure 6). On the wetland refilling in October 2015, a filamentous algal bloom occurred after the die off of the Red Water Milfoil (Figure 7).

During draw down events since 2014, Black Swans *Cygnus atratus* were commonly seen on the wetland indicating that submerged water plants were present at the site.

Figures 4, 5 and 8 indicate that the dominance of Samphire on the wetland bed and riparian edge did not change after three natural inundation events during 2011-12 (Table 1). However by May 2016 the following plant species were identified on the wetland bed during the October 2015 inundation draw-down event; Cumbungi, Blown Grass *Agrostis avenacea,* Brown Beetle Grass *Diplachne fusca,* Creeping Monkey-Flower *Mimulus repens,* Water Buttons *Cotula coronopifolia*, Prickly Sow-thistle *Sonchus asper*, Common Heliotrope *Heliotropium europaeum*, Smooth Heliotrope *Heliotropium curassavicum*, Bushy Starwort *Aster subulatus*, Pale Knot Weed *Polygonum lapathifolium* and scattered Samphire seedlings. The wetland bed survey was repeated in May 2020 20 months after the last inundation event in September 2018. The following species were identified; Cumbungi, Eastern Flat-top Saltbush *Atriplex lindleyi*, Smooth Heliotrope, Maireanna spp., Creeping Monkey-Flower, desiccated Bushy Starwort and small patches of Samphire (Figure 9).

Figure 6. May 2015 end of Red Water-Milfoil bloom during draw down (Photo: A Jensen)

Figure 7. A filamentous algal bloom on refilling the wetland October 2015 (Photo: A Jensen)

Figure 8. July 2012 Samphire dominate the drying event (Photo: A Jensen)

Figure 9. May 2020 dry event (Photo: M Harper)

4.2 Johnsons Waterhole Riparian Edge

Native riparian and low shrub species were planted on the floodplain around the wetland edge during 2014 and 2016. The only species planted below the lagoon's full supply level were River Red Gum seedlings of which few survived (K Strachan pers com.). During May 2016 small patches and odd Eucalyptus spp. and Cooba seedlings and saplings had germinated around the main lagoon edge. The majority of seedlings and saplings were healthy with some dense stressed patches. Odd young Lignum plants and patches of Cumbungi, Blown Grass and Bushy Starwort were also scattered around the lagoon edge on either side of the full supply level. Above the influence of full supply level Samphire was the dominant plant (Figures 10 and 11). In late summer 2017, (Mckillop 2017) established a vegetation survey line transect across the lagoon when the majority of the lagoon was inundated. The following plant species were recorded above the water level but below the influence of full supply level; Spreading Nut-head *Epaltes australis,* Brown Beetle Grass, Creeping Monkey-flower, Smooth Heliotrope, Eastern Flat-top Saltbush*,* Brown-head Samphire *Arthrocnemum leiostachyum*, Cumbungi, Bushy Starwort, River Club Rush *Scirpus validus*, Blown Grass, Hexham Scent *Melilotus indica* and Lignum. The riparian edge vegetation survey was again repeated in May 2020. Black Box *Eucalyptus largiflorens*, Cooba Sapling, Lignum bushes and odd River Red Gum saplings had formed dense patches or were scattered around the wetland edge. Understory species included Eastern Flat-top Saltbush, Pale-Poverty Bush *Bassia divaricata*, Lignum seedlings and odd Samphire plants. Above the inundation height Samphire still dominated (Figures 10 and 11).

Figure 10. Eastern shoreline of Johnsons Waterhole 2016 and repeat 2020 (Photo: M Harper)

Figure 11. South-eastern shoreline of Johnsons Waterhole 2016 and repeat 2020 (Photo: M Harper)

Figure 12. Johnsons Waterhole May 2020 (Photo: M Harper)

4.3 Johnsons Waterhole Adjoining Flow Path

In May 2016 small patches and odd Eucalyptus spp. and Cooba saplings and Lignum seedlings were scattered across the adjacent flow paths. Samphire dominated these areas with scattered areas and odd tussocks of Brown Beetle Grass and Blown Grass and Bushy Starwort (Figures 10 and 11). By May 2020 Samphire was not the dominant understory plant with only small patches and /or odd plants remaining. Similar to the edge of the wetland, patches of odd Black Box and Cooba saplings with Lignum bushes and odd River Red Gum saplings were scattered across the area. Young KI Tea Tree *Melaleuca halmaturorum* (a non-endemic species used in revegetation planting on the Ral Ral floodplain) were scattered amongst the other patches of trees within areas of the Ral Ral Creek end flow path.

Understory plants also included Bladder Salt Bush, Creeping Salt Bush *Atriplex semibaccata*, Bushy Groundsel *Senecio cunninghamii*, Smooth Heliotrope, Blue Rod *Morgania floribunda*, Clover spp and Grass spp. just germinated (Figures 12 and14).

Figure 10. Bookmark Creek end 2015 (Photo: K Strachan)

Figure 11: Bookmark Creek end 2016 (Photo: M Harper)

Figure 12. Bookmark Creek end 2020 (Photo: M Harper)

Figure 13: Ral Ral Creek end 2020 (Photo: M Harper)

Figure 14: Ral Ral Creek end 2020 (Photo: M Harper)

5 Conclusions

Revegetation actions around and adjacent to Johnsons Waterhole have significantly influenced the natural tree species regeneration at the site. Cooba are the most common species with scattered individuals of KI Tea Tree and River Red Gum. A number of mature seed bearing Cooba and KI Tea Trees have established upstream of the wetland from tree planting activities many decades ago. Mature KI Tea Tree are only found in this revegetation area but Cooba are uncommon outside this area. It is presumed that the seedlings of these two species germinated from seed dropped by the adult trees within the upstream revegetation plot and/or adjacent areas. The present River Red Gum poles and saplings scattered around Johnsons Waterhole have probably originated from the 2014 and 2015 tree planting activities (K Strachan pers com.). The closest mature seed bearing River Red Gum are along the edge of Ral Ral Creek.

Even though no comprehensive vegetation surveys of Johnsons Waterhole were undertaken until 2016, photographs of the site indicate that even after three natural inundation events during 2011-12, the dominance of Samphire on the wetland bed and riparian edge did not change during that period. However, by the October 2015 inundation draw down period other species such as Blown Grass can be seen in photographs, indicating the floristic composition of the wetland was now visually changing after seven inundation events over five years. By 2016 a number of medium to low salt tolerant species had established at the site which was confirmed by a site vegetation survey. A repeat survey in 2017 and 2020 found that the number and distribution of medium to low salt tolerant plant species had significantly increased and Samphire plants were now in the minority.

Over a period of seven years of receiving at least yearly inundation events Johnsons Waterhole moved from a highly saline wetland dominated by Samphire, to a wetland in transition. Samphire plants are still present though much reduced, but the wetland now also supports a range of medium to low salt tolerant species both during the wetland drawn down and dry phases. Figure 15 highlights the near complete ring of wetland edge riparian vegetation now established around Johnsons Waterhole. It took seven inundation events over five years for the floristic composition of the wetland to start changing, thus indicating that the frequency and number of inundation events was critical to the ability of this temporary wetland to start the transition away from a highly salinized site. The Johnsons Waterhole experience indicates that environmental watering actions will most likely need to be repeated in consecutive years for an extended period, before a floristic chance will occur at a salinized floodplain sites. Utilising irregular weir pool raising events to significantly increase the biodiversity at a salinized floodplain site will be a challenge.

Now that the desired state of biodiversity is moving towards the historical freshwater ecosystem, the watering regime could be reviewed to mimic a more natural sequence of wetting and drying. Given the threshold-to-fill of 35,000 ML/d, the natural frequency would be seasonal filling two in three years, with a maximum dry period of two years (provided that local rainfall is at least 80% of long-term average volumes). Based on observations at other Murray Valley wetlands, it is suggested that Johnsons waterhole could not sustain an extended drying event beyond two years without damage occurring to the site. The wetland could become salinized again because elevated saline groundwater issues driven by the upper pool level of Lock 5 weir have not changed.

Figure 15. Google satellite map of Johnsons Waterhole 2020

References

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